

What is claimed is:

1. A slurry dispensing apparatus for use with a chemical mechanical polishing tool for planarizing semiconductor substrates having irregular topology, said apparatus comprising:

a slurry dispensing manifold having a first end suspended over a polishing pad, and a second end for mounting to the chemical mechanical polishing tool;

a linear array of slurry dispensing nozzles positioned under said suspended manifold, each nozzle of said linear array providing an adjusted slurry mixture supplied from bifurcated supply lines, and each branch of said bifurcated supply lines having an adjustable flow control valve, a flow meter, and a check valve.

2. The apparatus of claim 1 wherein said bifurcated supply lines providing an adjusted volume of slurry emulsion and an adjusted volume of a liquid to each nozzle.

3. The apparatus of claim 1 wherein said adjusted volume of slurry emulsion and adjusted volume of a liquid provides the means for diluting the dispensed slurry through selected nozzles thereby fine-tuning the polishing rate on a substrate according to its topography.

4. The apparatus of claim 1 wherein each of said array of nozzles are

identical.

25 5. The apparatus of claim 1 wherein said slurry emulsion and liquid that is supplied to each branch of said bifurcated supply lines are fed from a source container, in series, through a variable flow control valve, a flow meter, and a check valve.

30 6. The apparatus of claim 5 wherein said variable flow control valve is slaved to an output signal provided by said flow meter in response to a programmable tool controller.

 7. The apparatus of claim 5 wherein said check valves mounted proximal
35 junction of said bifurcated supply lines performs as a mixing venturi for said nozzles.

 8. The apparatus of claim 5 wherein said slurry emulsion is a colloidal alumina or silica in deionized water, and said liquid is deionized water used for
40 dilution.

 9. The apparatus of claim 1 wherein said polishing is accomplished in two steps:

- a) adjusting nozzle dispense volume according to substrate topology;
- 45 b) allowing full flow for finishing polishing uniformity.

10. A chemical mechanical polishing apparatus for planarizing semiconductor substrates having irregular topology, comprising:

50 a polishing head assembly for holding a substrate therein and for rotating said substrate while in polishing contact with said polishing pad;

a polishing table for supporting and rotating a polishing pad thereon;

a dressing head for oscillating against the top surface of the polishing pad to restore the texture to the polishing pad;

55 a slurry dispensing manifold having a first end suspended over a polishing pad, and a second end for mounting to the chemical inechanical polishing tool;

a linear array of slurry dispensing nozzles positioned under said suspended manifold, each nozzle of said linear array providing an adjusted slurry mixture supplied from bifurcated supply lines, and

60 each branch of said bifurcated supply lines having an adjustable flow control valve, a flow meter, and a check valve.

11. The apparatus of claim 10 wherein said bifurcated supply lines providing an adjusted volume of slurry emulsion and an adjusted volume of a

65 liquid to each nozzle.

12. The apparatus of claim 10 wherein said adjusted volume of slurry emulsion and adjusted volume of a liquid provides the means for diluting the

dispensed slurry through selected nozzles thereby fine-tuning the polishing rate
70 on a substrate according to its topography.

13. The apparatus of claim 10 wherein each of said array of nozzles are
identical.

75 14. The apparatus of claim 10 wherein said slurry emulsion and liquid that
is supplied to each branch of said bifurcated supply lines are fed from a source
container, in series, through a variable flow control valve, a flow meter, and a
check valve.

80 15. The apparatus of claim 14 wherein said variable flow control valve is
slaved to an output signal provided by said flow meter in response to a
programmable tool controller.

16. The apparatus of claim 14 wherein said check valves mounted
85 proximal junction of said bifurcated supply lines performs as a mixing venturi for
said nozzles.

17. The apparatus of claim 14 wherein said slurry emulsion is a colloidal
alumina or silica in deionized water, and said liquid is deionized water used for
90 dilution.

18. The apparatus of claim 1 wherein said polishing is accomplished in two steps:

- i. adjusting nozzle dispense volume according to substrate topology;
- 95 ii. allowing full flow for polishing uniformity.

19. A method for planarizing semiconductor substrates having irregular topology, comprising the steps of:

- providing a chemical mechanical polishing tool;
- 100 providing a slurry dispensing manifold having a first end suspended over a polishing pad, and a second end for mounting to the chemical mechanical polishing tool;
- providing a linear array of slurry dispensing nozzles positioned under said suspended manifold, each nozzle of said linear array dispensing an
- 105 adjusted slurry mixture supplied from a bifurcated supply line, while each branch of said bifurcated supply line having an adjustable flow control valve, a flow meter, and a check valve.

20. The method of claim 19 wherein said bifurcated supply lines dispense
110 an adjusted volume of slurry emulsion and an adjusted volume of a liquid to each nozzle.

21. The method of claim 19 wherein said adjusted volume of slurry emulsion and adjusted volume of a liquid provides the means for diluting the

115 dispensed slurry through selected nozzles thereby fine-tuning the polishing rate
on a substrate according to its topography.

22. The method of claim 19 wherein each of said array of nozzles are
identical.

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23. The method of claim 19 wherein said slurry emulsion and liquid that is
supplied to each branch of said bifurcated supply lines are fed, in series, from a
source container, through a variable flow control valve, a flow meter, a check
valve, a junction, and said nozzle.

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24. The method of claim 23 wherein said variable flow control valve is
slaved to an output signal provided by said flow meter in response to a
programmable tool controller.

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25. The method of claim 23 wherein said check valves mounted proximal
said junction of said bifurcated supply lines performs as a mixing venturi for said
nozzles.

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26. The method of claim 23 wherein said slurry emulsion is a colloidal
alumina or silica in deionized water, and said liquid is deionized water used for
dilution.

27. The method of claim 19 wherein said polishing is accomplished in two steps.

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- i. adjusting nozzle dispense volume according to substrate topology;
- ii. allowing full flow for polishing uniformity.